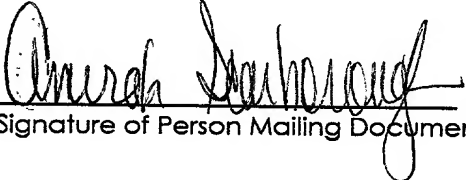


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**FOLDING KEYBOARD WITH AUTOMATIC STATE INITIATOR****BACKGROUND****1. Field of the Present Invention**

The present invention generally relates to the field of computer keyboards and more particularly to a folding keyboard with an automatic state initiator.

**2. History of Related Art**

Computer systems including personal digital assistants, notebook computers, laptop computers, personal computers, server systems, and enterprise systems are universally prevalent in a vast assortment of business, scientific, commercial, and home applications. Each of these computer systems utilizes a form of input device for receiving data from the user; with keyboards being the most prevalent form for such devices.

Keyboards typically have an elongated rectangular form with alphanumeric keys and special control keys appropriate to the data processing system arranged horizontally in parallel rows and staggered columns on the face of the keyboard. In addition to the special control keys, other keyboards include integrated mouse pads for controlling the movement of the cursor and for selecting various icons in operating systems utilizing graphical user interfaces.

In an effort to reduce the space occupied by the monitor and keyboard (i.e., footprint), monitor and data processing system manufacturers have taken to designing desktop monitors and data processing systems with space underneath them in order for the user to move the keyboard underneath when not in use. It would be beneficial if monitor and data processing system design could be independent of addressing keyboard storage issues or if the space required for accommodating keyboards could be minimized. Further, while data

processing systems are configured to enter a power saving "sleep" mode after a pre-determined time period has elapsed in which no activity on the keyboard or mouse pad is detected, it remains difficult, if not cumbersome for a user to selectively direct a data processing system to enter a power saving sleep mode.

5 Accordingly, it is highly desirable to provide for a keyboard that, when not in use, occupies a smaller footprint and that can direct the data processing system to enter into a sleep mode or a wake mode in response to the use state of the keyboard.

### SUMMARY OF THE INVENTION

10 The problems identified above are in large part addressed by a keyboard for a data processing system designed to selectively assume an extended position or a space-saving, collapsed position and further designed to generate a state signal for directing the data processing system to transition between a wake mode and a sleep mode in response to a  
15 change in the extension state of the keyboard.

Briefly and in general terms, a folding keyboard for a data processing system according to one embodiment of the invention includes two or more keyboard sections, keys attached to the keyboard sections, and a keyboard housing for receiving the keyboard sections. The keyboard is typically configured to assume a first position in which the  
20 keyboard sections are extended, and is further configured to assume a second position in which the keyboard sections are collapsed. In one embodiment, the keyboard would include one or more connectors attached to the keyboard sections for transitioning the keyboard from the extended position to the collapsed position. The keyboard may further include rollers for facilitating movement of the keyboard between the extended position and the collapsed  
25 position.

In another embodiment, the keyboard includes a locking mechanism for selectively maintaining the keyboard in the extended position or the collapsed position. The keyboard is preferably configured to transmit in response to a change in the extension state of the keyboard, a state signal to the data processing system for directing the data processing system  
30 to transition between a wake mode and a sleep mode. In one embodiment, the keyboard would include a state switch for generating the state signal to the data processing system.

Other aspects and advantages of the present invention will become apparent from the following detailed description when taken in conjunction with the accompanying drawings, illustrating by way of example the principles of the present invention.

### **BRIEF DESCRIPTION OF THE DRAWINGS**

5 Other objects and advantages of the invention will become apparent upon reading the following detailed description and upon reference to the accompanying drawings in which:

**FIG. 1** is a top plan view of a keyboard according to one embodiment of the present invention;

10 **FIG. 2** is a side plan view of a keyboard according to one embodiment of the present invention depicting the keyboard in a position between an extended position and a collapsed position;

**FIG. 3** is a side plan view of a keyboard according to one embodiment of the present invention depicting the keyboard in a collapsed position;

**FIG. 4** is a side plan view of a keyboard according to one embodiment of the present invention depicting the keyboard in an extended position; and

15 **FIG. 5** depicts a data processing system including the keyboard of **FIG. 1**.

20 While the invention is susceptible to various modifications and alternative forms, specific embodiments thereof are shown by way of example in the drawings and will herein be described in detail. It should be understood, however, that the drawings and detailed description presented herein are not intended to limit the invention to the particular embodiment disclosed. On the contrary, the invention is limited only by the claim language.

### **DETAILED DESCRIPTION OF THE INVENTION**

25 As shown in the drawings for purposes of illustration, the present invention contemplates a keyboard for a data processing system, the keyboard being designed to assume an extended position or a space-saving, collapsed position. For purposes of clarity, the position of the keyboard (i.e., extended position, collapsed position, or a position between the two) is hereinafter referred to as the "extension state of the keyboard." The keyboard is further designed to generate a state signal for directing the data processing system to  
30 transition between a wake mode and a sleep mode in response to a change in the extension state of the keyboard. Throughout the description and the drawings, elements which are the same will be accorded the same reference numerals.

35 Turning now to the drawings, **FIG. 1** and **FIG. 2** depict a top plan view and a side plan view, respectively, of a keyboard **100** according to one embodiment of the invention. In the depicted embodiment, keyboard **100** includes a keyboard housing **150** and a set of

keyboard sections 160, 170, 180, and 190, respectively. Keys 195 are connected to one or more of the keyboard sections. In the depicted embodiment, keys 195 are connected to keyboard sections 160, 170, and 180 and a palm rest having mouse pad 199 is included in keyboard section 190.

5 Keyboard housing 150 may be suitably sized and shaped for receiving one or more of keyboard sections 160, 170, 180, and 190. In the depicted embodiment, keyboard housing 150 includes a mounting plate 151, a back plate 152, a top plate 153, a front plate 154, and a slider 210 operatively coupled to mounting plate 151. Front plate 154 is movably attached to top plate 153 by way of a suitable connector so as to selectively permit front plate 154 to be  
10 moved to (and in an alternative embodiment, remain in) an open position in order to allow keyboard housing 150 to receive keyboard sections 160, 170, 180, and 190 when keyboard 100 is in the collapsed position. In the depicted embodiment, the connector is implemented with a hinge 250.

Keyboard housing 150 is movably attached to the set of keyboard sections by way of  
15 a suitable connector so as to permit keyboard housing 150 to receive the set of keyboard sections. In the depicted embodiment, the connector is implemented by a hinge 110 and slider 210. Hinge 110 connects a trailing edge 265 of keyboard section 160 to slider 210. Slider 210 is operatively coupled to mounting plate 151 so as to permit trailing edge 265 of keyboard section 160 to travel between a front edge 260 and a back edge 255 of mounting plate 151.

20 While mounting plate 151 is shown in the depicted embodiment to be the bottom of keyboard housing 150, it is to be understood that any plate of keyboard housing 150 including side plates (which are not depicted) may be utilized as the mounting plate for connecting slider 210. Further, it is to be understood that one or more slider(s) 210 may be implemented along the trailing edge 265 of keyboard section 160 to facilitate the movement  
25 of trailing edge 265 between the front edge 260 and a back edge 255 of mounting plate 151.

Keyboard sections are movably attached to one another by way of suitable connectors so as to permit keyboard 100 to assume a first position in which each of the keyboard sections 160, 170, 180, and 190 are extended from keyboard housing 150 (as depicted and described in more detail in FIG. 4 below) and to assume a second position in  
30 which each of the keyboard sections are collapsed and contained within keyboard housing 150 (as depicted and described in more detail in FIG. 3 below). As depicted in the present embodiment, leading edge 270 of keyboard section 160 is movably attached to trailing edge 275 of keyboard section 170, leading edge 280 of keyboard section 170 is movably attached to trailing edge 285 of keyboard section 180, and leading edge 290 of keyboard section 180 is

movably attached to trailing edge 285 of keyboard section 190 by way of suitable connectors. In the depicted embodiment, the connectors are implemented with a hinge 120, a hinge 130, and a hinge 140, respectively. Each of hinge 110, hinge 120, hinge 130, and hinge 140 may (as depicted) run the length of front edge 260 of keyboard housing 150 and the length of the trailing edges and the leading edges of the keyboard sections 160, 170, 180, and 190, respectively. Typically, keys 195 are (as depicted) arranged in parallel, horizontal rows on keyboard sections 160, 170, and 180 in order to facilitate placement and operations of hinges 120, 130, and 140 so as to permit adjacent keyboard sections to be folded horizontally along a line between adjacent rows of the keys.

In alternative embodiments (not depicted), hinges 110, 120, 130, and 140, respectively, may include a series of hinges mounted along the adjacent edges of keyboard housing 150 and keyboard sections 160, 170, 180, and 190, respectively, the side edges of keyboard housing 150 and keyboard sections 160, 170, 180, and 190, respectively, or a combination of the foregoing. Hinges 110, 120, 130, and 140 may be of any suitable type of hinge structure appropriate for the expected usage such as a single piano hinge, suitable protruding members and notches for receiving such members molded into the applicable edges of keyboard sections, and other hinges known to persons skilled in the applicable arts. Further, hinges 110, 120, 130, and 140, respectively, may preferably incorporate electrical signal connectors suitable for transmitting signals generated when any of the keys or the mouse pad of keyboard sections 160, 170, 180, and 190 are depressed or is utilized, respectively.

Keyboard 100 is further preferably configured to transmit a state signal to the data processing system directing the data processing system to transition between a wake mode and a sleep mode in response to a change in the extension state of keyboard 100. In the depicted embodiment, switch 240 senses a change in the extension state of keyboard 100 upon movement of hinge 120 and transmits the appropriate state signal. It is to be understood that while switch 240 is depicted as connected to hinge 100, switch 240 may be connected to any of hinges 110, 120, 130, and 140. In an alternative embodiment (not shown), switch 240 may be coupled to slider 210 and wherein responsive to the direction of movement of slider 210, the state signal contains information for directing the data processing system to transition between a wake mode and a sleep mode. Typically, the state signal contains information for directing the data processing system to transition to a wake mode upon keyboard 100 entering an extended state and to transition to a sleep mode upon keyboard 100 entering a collapsed state.

To facilitate movement of keyboard 100 between an extended state and a collapsed state, keyboard 100 may also include rolling devices. As depicted in the present embodiment, keyboard 100 includes roller 220 attached to leading edge 280 of keyboard section 170 and trailing edge 285 of keyboard section 180 and roller 230 attached to leading edge 299 of keyboard section 190. It is to be understood that rollers 220 and 230 may run the length of the trailing edges and the leading edges of the keyboard sections 170, 180, and 190, respectively, or alternatively, may include a series of rollers mounted along the adjacent edges of keyboard sections 170 and 180 and the leading edge of keyboard section 190, respectively, the side edges of keyboard 170, 180, and 190, respectively, or a combination of the foregoing.

Turning to FIG. 3, keyboard 100 is depicted in a collapsed state. In the collapsed state (as depicted), slider 210 has traveled to back edge 255 of keyboard housing 150, hinges 110, 120, 130, and 140 have operatively rotated so as to permit keyboard sections 160, 170, 180, and 190 to be contained within keyboard housing 150. In one embodiment, any keys or mouse pad contained on the keyboard section closest to the front edge 260 of keyboard housing 150 remain accessible when keyboard 100 is in a collapsed state. Typically, when transitioning to the collapsed state, switch 240 transmits a state signal for directing the data processing system to transition to a sleep mode.

Turning to FIG. 4, keyboard 100 is depicted in an extended state. In the extended state (as depicted), slider 210 has traveled to front edge 260 of keyboard housing 150, hinges 110, 120, 130, and 140 have operatively rotated so as to permit keyboard sections 160, 170, 180, and 190 to be extended preferably so as to permit the keyboard to lie flat on a surface. Typically, when transitioning to the extended state, switch 240 would have transmitted a state signal for directing the data processing system to transition to a wake mode. Keyboard 100 may include lock 410 which is operatively coupled to mounting plate 151 and configured to selectively maintain keyboard 100 in an extended state or a collapsed state. In one embodiment, lock 410 may restrict movement of slider 210 so as to cause keyboard 100 to remain in an extended state. In an alternative embodiment, lock 410 may be operatively coupled to mounting plate 151 and configured to restrict movement of leading edge 299 of keyboard section 190 when leading edge 299 is inside keyboard housing 150 so as to cause keyboard 100 to remain in a collapsed state.

In yet alternative embodiments, lock 410 may include a series of locks mounted along the adjacent edges of keyboard housing 150 and keyboard sections 160, 170, 180, and 190, respectively, the side edges of keyboard housing 150 and keyboard sections 160, 170, 180,

and 190, respectively, or a combination of the foregoing. Lock 410 may be of any type of suitable lock structure appropriate for the expected usage such as a pin which may extend through mounting plate 151 and which may be selectively engaged to restrict movement of slider 210; one or more pins or latches attached to keyboard housing 150 and keyboard sections 160, 170, 180, and 190, respectively, and which may be selectively engaged to couple keyboard housing 150 and keyboard sections 160, 170, 180, and 190, respectively; and other locks known to persons skilled in the applicable arts.

Turning to FIG. 5, selected features of a data processing system 500 according to one embodiment of the present invention are shown. In the depicted embodiment, data processing system 500 includes one or more processors P1 505 through Pn 510 that are connected and have access to a system memory 515 via a system bus 530. Processors P1 505 through Pn 510 may be implemented with any of a variety of general purpose microprocessors including, as examples, the "PowerPC" family of processors from IBM Corporation and x86 type processors such as the "Pentium" family of processors from Intel Corporation. System memory 515 is typically implemented with volatile storage elements such as an array of dynamic RAM (DRAM) components.

A bus bridge 540 provides an interface between system bus 530 and a peripheral bus 545. Peripheral bus 545 is typically implemented according to an industry standard peripheral bus protocol or specification such as the Peripheral Components Interface (PCI) protocol as specified in *PCI Local Bus Specification Rev 2.2*, from the PCI Special Interest Group ([www.pcisig.org](http://www.pcisig.org)). Data processing system 500 may include one or more peripheral devices 550 and 555 connected to peripheral bus 545. These peripheral devices could include as examples, a hard disk controller, a high speed network interface card, a graphics adapter, and so forth as will be familiar to those skilled in the design of microprocessor-based data processing systems.

Data processing system 500 further includes a keyboard controller 520 connected to peripheral bus 545 and a keyboard 100 (according to the present invention) connected to keyboard controller 520 via a keyboard "bus" 535. Keyboard controller 520 is configured to receive keyboard signals from keyboard 100 via keyboard bus 535 and communicate those signals to processor(s) P1 505 through Pn 510 via peripheral bus 545. These keyboard signals may include a "wake" signal that is generated when keyboard 100 is extended from a collapsed position and a "sleep" signal that is generated when keyboard 100 is collapsed from an extended position. In an alternative embodiment, keyboard controller 520 may be connected to system bus 530 and may be configured to receive keyboard signals from keyboard 100 via keyboard bus 535 and communicate those signals to processor(s) P1 505

through Pn 510 via system bus 530.

Keyboard bus 535 may include a conventional PS/2 bus as is known in the art, a Universal Serial Bus, or both. Keyboard controller 520 may be implemented with or  
5 comprise a portion of a commercially distributed component such as the SuperIO chip from National Semiconductor (www.national.com). In an embodiment where either the “wake” signal, the “sleep” signal, or both are not recognized by the operating system, keyboard controller 520 may further include dedicated hardware and a driver installed in system  
10 memory 515 that permit the data processing system 500 to interpret the wake and sleep signals from keyboard 100 and instruct processors P1 505 through Pn 510 to transition to appropriate wake or sleep modes in response to those signals.

A person skilled in the art will appreciate that as used herein, the terms “sleep” mode and “wake” mode refer to power managed state transitions entered into by a data processing system in an effort to appropriately manage power consumption requirements. So as to lower  
15 power consumption requirements, the data processing system may enter one or more levels of a “sleep” mode. Such “sleep” modes may include a “suspend” state which, when activated, may slow down the CPU clock(s), spin down applicable drive units, save the state of various applications then running, and suspend or stop other peripheral functions. “Wake” mode typically involves increasing the power consumption requirements and if applicable, “re-awakening” the data processing system to assume a typical operating state in which the CPU  
20 clocks, applicable drive units, applications, and other peripheral functions are activated.

It will be apparent to those skilled in the art having the benefit of this disclosure that the present invention contemplates a keyboard for a data processing system, the keyboard being designed to selectively assume an extended position or a space-saving, collapsed  
25 position within a keyboard housing. The keyboard is further designed to generate a state signal for directing the data processing system to transition between a wake mode and a sleep mode in response to a change in the extension state of the keyboard. It is understood that the forms of the invention shown and described in the detailed description and the drawings are to be taken merely as presently preferred examples and that the invention is limited only by  
30 the language of the claims.